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PATENT ABSTRACTS OF JAPAN

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(54) Fe-Ni ALLOY STOCK FOR SHADOW MASK HAVING EXCELLENT PROPERTY
OF PIERCING BY ETCHING

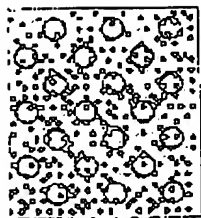


図1: エッチング前のFe-Ni合金の表面状態

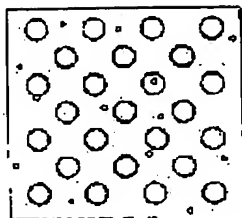


図2: エッチング後のFe-Ni合金の表面状態

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a stock for shadow masks free from dispersion of the electron beam transmission hole diameter and having excellent properties of piercing by etching.

SOLUTION: The Fe-Ni alloy stock for shadow mask having excellent uniformity of hole diameter at piercing by etching has a chemical composition consisting of 34-38% Ni, $\geq 0.5\%$ Mn and the balance Fe with inevitable impurities or accompanying element (where respective contents of C, Si, Al, S and P are made to $\geq 0.10\%$ C, $\leq 0.30\%$ Si, $\leq 0.30\%$ Al, $\leq 0.005\%$ S and $\leq 0.005\%$ P) and also containing, if necessary, 5-40 ppm B and 5-40 ppm N and in which $\geq 2,000$ pieces/mm² of precipitates and inclusions of 0.01-5 μm diameter are dispersed at the stock surface. By applying etching to it, the stock for shadow mask in which electron beam transmission holes free from dispersion of hole diameter in the part pierced by etching and excellent uniformity of hole diameter are formed can be obtained.

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CLAIMS

[Claim(s)]

[Claim 1] Based on mass percentage (%) (it is hereafter written as %), 34 - 38% and Mn are contained for nickel 0.5% or less. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less- the electron ray transparency characterized by making this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- the material for shadow masks which is excellent in the homogeneity of the aperture for [a hole] carrying out etching punching

[Claim 2] Based on mass percentage (%) (it is hereafter written as %), are contained 34 - 38%, and Mn for nickel, and 5-40 ppm and 5-40 ppm N are contained for 0.5% or less and B. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less- the electron ray transparency characterized by making this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- the material for shadow masks which is excellent in the homogeneity of the aperture for [a hole] carrying out etching punching

[Claim 3] Based on mass percentage (%) (it is hereafter written as %), 34 - 38% and Mn are contained for nickel 0.5% or less. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less- **** which made this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- electron ray transparency -- the electron ray transparency

which is excellent in the homogeneity of the aperture by etching punching characterized by forming a hole -- the material for shadow masks in which the hole was formed [Claim 4] Based on mass percentage (%) (it is hereafter written as %), are contained 34 - 38%, and Mn for nickel, and 5-40 ppm and 5-40 ppm N are contained for 0.5% or less and B. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less- **** which made this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- electron ray transparency -- the electron ray transparency which is excellent in the homogeneity of the aperture by etching punching characterized by forming a hole -- the material for shadow masks in which the hole was formed

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] the Fe-nickel system alloy material by which this invention is used for the shadow mask processed by detailed etching -- being related -- especially -- etching processing -- transparency of an electron ray -- the electron ray transparency which has a uniform aperture when a hole is punched -- it is related with the material for Fe-nickel system alloy shadow masks from which a hole is obtained the electron ray transparency this invention excels [transparency] in the homogeneity of the aperture by etching punching again -- it is related also to the material for Fe-nickel system alloy shadow masks in which the hole was formed

[0002]

[Description of the Prior Art] Conventionally, generally mild steel was used for the shadow mask for color Braun tubes. However, if continuous duty of the Braun tube is carried out, temperature rises by irradiation of an electron ray, according to thermal expansion, the irradiation position of a fluorescent substance and an electron ray will stop corresponding, and it will produce color gap. [a shadow mask's] That is, when operating the color picture tube, the electron beam which passes puncturing of a shadow mask is $\frac{1}{3}$ or less [of the whole], and since bombardment [the remaining electron beams / a shadow mask], the temperature rise of a shadow mask happens. Then, the Fe-nickel system alloy with which the field of the shadow mask for color Braun tubes is also called "36 Alloy" of a low-thermal expansion coefficient from a viewpoint of color gap is used in recent years.

[0003] As the manufacture method of the material for Fe-nickel system alloy shadow masks, a predetermined Fe-nickel system alloy is cast to an ingot after the ingot by refinement furnace outside by the vacuum melting or LF for example, in a VIM furnace, after forging, it hot-rolls, the scale of the front face of slab is removed, cold rolling and annealing (recrystallization annealing) are repeated, and the last cold rolling finished to predetermined sheet thickness with a thickness of 0.3mm or less is performed after the last annealing. Then, a slit is carried out and the material for shadow masks is obtained as the predetermined board width. The material for shadow masks makes a photoresist both sides with ** after degreasing, and it prints a pattern, and piercing is carried out in an etching reagent after development, it is cut separately, and becomes a flat mask. After a flat mask is annealed in a non-oxidizing atmosphere and press-working-of

sheet-metal nature is given to it (carried out to ultimate-pressure total material by the pre annealing method before this annealing etching), spherical-surface fabrication of it is carried out by the press at a mask gestalt. And after degreasing, melanism processing is performed to the mask by which spherical-surface fabrication was carried out in a steam or combustion gas atmosphere by the last, and it forms a melanism oxide film in a front face at it. In this way, a shadow mask is produced. this invention -- setting -- after the last cold rolling -- electron ray transparency -- the material with which etching for punching of a hole is presented is named generically, and it is called the material for shadow masks moreover, a flat mask -- including -- electron ray transparency -- the material before press forming in which the hole was formed -- electron ray transparency -- it is included as a material for shadow masks in which the hole was formed

[0004] etching processing of the common knowledge such whose a shadow mask generally uses ferric chloride solution -- transparency of an electron ray -- a hole is formed Etching processing applies photo lithography technology, has much perfect circle-like openings with a diameter of 80 micrometers on the single-sided front face of an alloy band, and after forming the resist mask which has perfect circle-like opening with a diameter of 180 micrometers in the position where another front face faces, it is performed by spraying ferric chloride solution in the shape of a spray.

[0005] Although the shadow mask where minute opening aligned precisely is obtained by this etching processing, it originates in local dispersion of etching conditions etc., and dispersion arises in the diameter of opening. If this dispersion becomes large, when a shadow mask is included in the Braun tube, color gap will arise and it will become incongruent as a product. Conventionally, dispersion in this diameter of opening reduced the yield at the time of carrying out etching processing of the shadow mask, and caused cost increase.

[0006] About the improvement of etching processing punching nature, the past and various examination are made and JP,05-311357,A has advocated making crystal orientation random in respect of material by making the degree of set of the {100} sides to a rolling side into less than 35%, for example. JP,5-311358,A has indicated regulating the inclusion rolling-direction total length per unit area of a rolling equilibrium profile. Moreover, JP,7-207415,A has indicated regulating Mn and S concentration, regulating Si and C concentration further, and improving etching processing punching nature by in addition regulating the cross-section cleanliness of oxide system inclusion. These are related to regulation of an overall texture, and regulation of inclusion.

[0007]

[Problem(s) to be Solved by the Invention] however, poor etching (superfluous advance

of etching in comparison with the circumference) which cannot be prevented with such well-known technology as a result of this invention persons' inquiring wholeheartedly and which is produced partially and the electron ray transparency as the result -- it was found out that the dispersion phenomenon of the aperture of a hole exists such poor etching -- etching -- electron ray transparency -- the time of holding up the material for shadow masks after forming a hole to light, and observing it -- a hole -- that near shines brightly and can be seen -- it is -- a very local hole -- surrounding etching is poor and it is in the inclination for an aperture to become large from the diameter of a target

[0008] then, this invention -- etching -- electron ray transparency -- in case you form a hole, let it be a technical problem to offer the Fe-nickel system alloy material which aperture dispersion of an etching punch station with local poor etching does not produce [0009]

[Means for Solving the Problem] the above from a completely new viewpoint which is not in the former that this invention persons should attain the above-mentioned technical problem -- it inquired wholeheartedly about the cause which the local abnormalities in corrosion generate consequently, a Fe-nickel system alloy material -- setting -- etching -- electron ray transparency -- when forming a hole, the detailed sludge and detailed inclusion which exist in a material came to study having affected it greatly For the Fe-nickel system alloy material in which a detailed sludge and detailed inclusion exist for the whole material mostly, it came to find out that it is hard to generate aperture dispersion of an etching punch station with such local poor etching. In this case, when with a size of 0.01 micrometers - 5 micrometers sludge and inclusion's existence frequency became two or more [2000 //mm] on the material front face, it became clear that the above-mentioned dispersion generating depressor effect is discovered.

[0010] As a result of identifying the component of the particle of a sludge and inclusion, it was carbide, such as a sulfide of the oxide of nitrides, such as BN, TiN, and AlN, MnO, MgO, CaO and TiO, Al₂O₃, and SiO₂ grade, MnS and CaS, and MgS₂ grade, and TiC, SiC, etc. The particle of such a sludge and inclusion was immersed in the sample into acidic solutions, such as diluted hydrochloric acid and a dilute sulfuric acid, after carrying out the anodic dissolution of it for several second - dozens seconds with the potential of an activity dissolution field, it was appeared as a pit (pitting), therefore the particle of a sludge and inclusion also made it clear that existence frequency could be evaluated by pit density (piece/mm²).

[0011] Although the detail of the mechanism in which minute inclusion or a minute sludge suppresses dispersion in an etching opening diameter is not clear, generally

etching processing of this invention which can be presumed as follows, and the Fe-nickel system alloy which involves is carried out at a shadow mask using ferric-chloride solution. Under the present circumstances, the portion which does not apply and carry out opening of the resist film to material is covered, and it is made for ferric-chloride solution to be only equivalent to the portion which carries out opening. If detailed inclusion or a detailed sludge (it is hereafter described as inclusion) exists in this opening, this inclusion will act as an origin of corrosion and etching of **** will be promoted. If inclusion does not exist in all openings, every opening will be in the same etching state, and dispersion in an aperture will not be produced. However, in actual industrial production, making inclusion there be nothing exists in some difficult openings by probability with the inclusion used as the origin of corrosion. In opening with the origin of such corrosion, from opening without the origin of the circumference of it, an etch rate becomes quick and the diameter of opening becomes larger. Furthermore, in opening with an origin, in order that etching may begin earlier than opening without the origin of the circumference of it, opening with an origin serves as an anode electrochemically, and opening in which an origin does not exist serves as a cathode. In this case, the difference of a corrosion rate becomes still larger and the difference of the diameter of opening after an etching end also becomes large. On the other hand, if a material contains detailed inclusion more than a certain frequency, in every opening, equally, it can exist and dispersion will not produce inclusion in the diameter of opening. Therefore, dispersion of the aperture of the aforementioned etching punch station in this invention Since the inclusion used as the origin of corrosion exists below by a certain frequency, the homogeneity of the distribution which lets the whole material of inclusion pass is lost. On the average, opening of most concerning inclusion is different and opening which differs in opening without regards to inclusion, opening with the large grade [inclusion] of relation, or a relation state with inclusion occurs. the porous wall side by the difference of a corrosion rate arising, and a hole -- it can be called local poor etching under electron microscope observation relevant to the profile section, an aperture, etc., and can evaluate as dispersion in an opening diameter Existence of inclusion can be checked by about 1:1 as a pit mentioned above.

[0012] ** -- by this invention, a concept introduces detailed inclusion into Fe-nickel system alloy **** positively conversely conventionally more than fixed numbers like -- local poor etching -- eliminating -- dispersion in an opening diameter -- exclusion -- or -- it is going to decrease -- it is a thing

[0013] It is based on the above knowledge and consideration. this invention Based on

mass percentage (%) (it is hereafter written as %), 5-40 ppm and 5-40 ppm N are contained [nickel / 34 - 38%, and Mn] for B 0.5% or less and if needed. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less - the electron ray transparency characterized by making this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- the material for shadow masks which is excellent in the homogeneity of the aperture for [a hole] carrying out etching punching is offered In addition, the diameter of inclusion is the minimum diameter of circle containing the inclusion. In relation to the material after etching, this invention is based on mass percentage (%) again. 5-40 ppm and 5-40 ppm N are contained [nickel (%) / nickel / is written hereafter) / 34 - 38%, and Mn] for B 0.5% or less and if needed. Remainder Fe and unescapable impurity, or company element -, however C:0.10% or less, In the Fe-nickel system alloy material for shadow masks which consists of less than [Si:0.30%], less than [aluminum:0.30%], S:0.005% or less, and P:0.005% or less - **** which made this material front face distribute the sludge and inclusion whose diameter is 0.01 micrometers - 5 micrometers two or more [2000 //mm] -- electron ray transparency -- the electron ray transparency which is excellent in the homogeneity of the aperture by etching punching characterized by forming a hole -- the material for shadow masks in which the hole was formed is offered

[0014]

[Embodiments of the Invention] nickel content of the Fe-nickel system alloy material in this invention has specified it as 34 - 38%. This is because a coefficient of thermal expansion cannot become large and it cannot be used as an object for shadow masks, when nickel content separates from this range. Mn is added by the iron system alloy in order to make harmless S which checks hot-working nature. However, when it exceeds 0.5%, a material becomes hard and the processability will be inferior. Therefore, the upper limit of Mn content was determined as 0.5%.

[0015] Moreover, although the upper limit of C, Si, Al, and P which are contained as an impurity or a company element in a Fe-nickel system alloy is regulated with 0.10%, 0.30%, 0.30%, and 0.005%, respectively, when these elements contain this exceeding this concentration, it is because etching punching nature is checked and it cannot be used as a material for shadow masks. S will check the hot-working nature of a material remarkably, if it exceeds 0.005%. Therefore, the upper limit of S content was determined as 0.005%. In addition, 5-40 ppm and 5-40 ppm N can be made to contain B for the

purpose of introducing detailed BN particle.

[0016] Drawing 1 (a) and (b) are (a) and a ** type view which explains a situation with (b) when generating, when aperture dispersion of an etching punch station in the material material which has a difference in the occurrences of a pit does not occur. If a material contains detailed inclusion like drawing 1 (a) more than a certain frequency, in every opening, it can exist, aperture dispersion of an etching punch station will not generate inclusion equally, and dispersion will not arise in the diameter of opening. However, if the inclusion [as / in drawing 1 (b)] used as the origin of corrosion exists below by a certain frequency, opening which differs in opening without regards to inclusion, opening with the large grade / inclusion / of relation, or a relation state with inclusion will occur, and when local poor corrosion arises, aperture dispersion of an etching punch station will occur. On the whole, these can be evaluated as dispersion in an opening diameter.

[0017] Observation of inclusion was performed by analyzing pit-like inclusion marks by EDS, after carrying out an anodic dissolution in an acidic solution. In addition, an anodic dissolution has not dissolved and analyzed MnS among inclusion. Moreover, inclusion density was performed by measuring the number of pits with a diameter of 0.01 micrometers - 5 micrometers in SEM.

[0018] Inclusion serves as an origin of corrosion and it has the effect which suppresses dispersion in the aperture of an etching punch station by existence by the predetermined frequency which lets the whole material pass. This effect is accepted only in the inclusion whose diameter is 0.01-5 micrometers, and when the number becomes two or more [2000 //mm] on a material front face, it is discovered. If a diameter is too small for becoming the origin of corrosion in less than 0.01 micrometers and it exceeds 5 micrometers conversely, inclusion may serve as an obstacle of etching. Two or more [2000 //mm] need the number of inclusion (and the pit) to realize sufficient frequency to discover dispersion depressor effect. Usually, it is desirable that 2500-20000 pieces /are distributing two times mm. In addition, the number of an inclusion pit is the number at the time of measuring by SEM observation after the anodic dissolution in the inside of the acidic solution mentioned above.

[0019] In the manufacture method of the material for Fe-nickel system alloy shadow masks, a predetermined Fe-nickel system alloy is cast to an ingot after the ingot by refinement furnace outside by the vacuum melting or LF for example, in a VIM furnace, after forging, it hot-rolls, the scale of the front face of slab is removed, cold rolling and annealing (recrystallization annealing) are repeated, and the last cold rolling finished to predetermined sheet thickness with a thickness of 0.3mm or less is performed after the

last annealing as stated first. Then, a slit is carried out and the material for shadow masks is obtained as the predetermined board width. The material for shadow masks makes a photoresist both sides with ** after degreasing, and it prints a pattern, and piercing is carried out in an etching reagent after development, it is cut separately, and becomes a flat mask. After a flat mask is annealed in a non-oxidizing atmosphere and press-working-of-sheet-metal nature is given to it (carried out to ultimate-pressure total material by the pre annealing method before this annealing etching), spherical-surface fabrication of it is carried out by the press at a mask form. And after degreasing, melanism processing is performed to the mask by which spherical-surface fabrication was carried out in a steam or combustion gas atmosphere by the last, and it forms a melanism oxide film in a front face at it. In this way, a shadow mask is produced. Specifically, the thickness of the Fe-nickel system alloy material used for a shadow mask is usually 0.01-0.3mm, repeats cold rolling and recrystallization annealing and finishes a board with a thickness [after hot rolling] of 2-6mm as a material for shadow masks with a thickness of 0.01-0.3mm with the last cold rolling after the last recrystallization annealing. In this process of a series of, the processes which contribute to generation of inclusion are hot rolling and annealing. In order to introduce the inclusion of a detailed sludge system into a Fe-nickel system alloy, it is necessary to rationalize the heat history of the material in hot rolling and recrystallization annealing. Moreover, annealing without recrystallization, for example, an aging treatment, and stress relief tempering can be carried out. In cold rolling, although dissolution/deposit of the inclusion of a sludge system do not take place, the workability etc. needs to take affecting it into consideration.

[0020] Explanation is added about these points.

** Hot rolling : although hot rolling of a Fe-nickel system alloy is usually performed at 950-1250 degrees C, in this temperature requirement, the inclusion of a sludge system dissolves in ****. Then, the board after a hot rolling end is annealed and the inclusion of a sludge system is deposited in a cooling process. As a temperature requirement annealed from deposit speed falling if many deposits of the inclusion of a sludge system advance at the temperature of 900 degrees C or less and temperature becomes less than 700 degrees C, 900-700 degrees C is suitable.

[0021] ** Recrystallization annealing : there are two kinds in the case of carrying out by low temperature and the long time using the case where it carries out on condition that an elevated temperature and a short time using a continuous-annealing line, and a batch-type annealing furnace. In order to prevent scaling of material, it is necessary to fill the interior of a heating furnace with any case by the inert gas containing hydrogen

gas or hydrogen. Moreover, it is necessary to adjust the size of the recrystallization grain after annealing so that the average diameter of crystal grain may be set to 5-30 micrometers. It is the diameter of crystal grain which applied correspondingly and measured the intercept method indicated to be the average diameter of crystal grain by Japanese Industrial Standards JIS H0501 in the cross section parallel to a rolling direction here. Moreover, in appearance of an organization, after making a mirror plane to an observation side by mechanical polishing, it was immersed in nitric acid-acetic acid solution. the transparency punched by etching when the diameter of crystal grain after the last annealing exceeded 30 micrometers -- the wall surface of a hole is ruined and the problem that an etch rate falls further arises moreover, the case where the diameter of crystal grain in intermediate annealing exceeds 30 micrometers -- the organization after the last annealing -- an ununiformity (state, in which big crystal grain and small crystal grain were intermingled) -- becoming -- transparency -- an etch rate becomes uneven while the wall surface of a hole is ruined On the other hand, if the diameter of crystal grain is made smaller than 5 micrometers, the problem of the processability in the next cold rolling with which it becomes difficult to control the diameter of crystal grain in material uniformly falling will arise. Hot rolling and recrystallization annealing are performed on arbitrary conditions, and a deposit can be urged for annealing without recrystallization to ***** after a ultimate-pressure total.

[0022] ** Workability of the last cold rolling : if workability exceeds 40%, rolling texture will develop into a degree very much, and an etch rate will fall. On the other hand, if workability is less than 10%, in annealing for giving the press-forming nature in front of press working of sheet metal, a non-recrystallized structure will remain and press-forming nature will fall.

[0023] going via the hot rolling and cold rolling process step which satisfy such conditions -- etching -- electron ray transparency -- in case a hole is formed, the Fe-nickel system alloy material which dispersion in the diameter of opening by poor local etching does not produce is obtained

[0024] this -- electron ray transparency -- a hole -- material **** which made much inclusion distribute by *****ing for formation -- electron ray transparency -- the electron ray transparency which is excellent in the homogeneity of an aperture without aperture dispersion of an etching punch station in which the hole was formed -- the material for shadow masks in which the hole was formed is obtained

[0025]

[Example] nickel concentration and the concentration of an impurity (company element)

-- nickel:35.8-36.5%, Mn:0.2-0.5%, and Si: -- 0.02 - 0.3%, S:0.0005 - 0.005%, aluminum:0.01-0.3%, C:0.001 - 0.1%, P:0.001 - 0.003%, and B -- 5-40 ppm and N -- the range of 5-40 ppm -- adjusting -- a degree -- an ingot -- hot forging -- it hot-rolled Subsequently, cold rolling and annealing were repeated after surface scale removal, the last cold rolling was performed, and the alloy band of 0.2mm thickness was manufactured. In addition, it changed in the mode which mentioned above composition of an ingot, the ingot method and subsequent after [hot rolling] cooling conditions, and the heat treatment method, and the amount of inclusion or a sludge was changed.

[0026] The analysis result of the inclusion of the corrosion origin section at the time of manufacturing in following process ** - ** to drawing 2 is shown. Existence of sludges, such as BN, and the inclusion of aluminum₂O₃ grade is guessed.

** In the aforementioned hot rolling, thickness processes slab to 2-6mm by the 950 degrees C - 1250 degrees C temperature requirement. Furthermore, carry out the average cooling rate from 900 degrees C in the cooling process after hot rolling to 700 degrees C in 0.5 degrees C/second or less, and it sets to all the ** aforementioned recrystallization annealing. By adjusting temperature to 850 degrees C - 1100 degrees C, and carrying out plate leaping of the material continuously into the heating furnace which filled the interior with the inert gas containing hydrogen or hydrogen The average diameter of a recrystallization grain is adjusted to 5-30 micrometers, and workability of cold rolling before recrystallization annealing of the ** aforementioned last is made into 50 - 85%, and workability of the aforementioned last cold rolling is made into 10 - 40%.

[0027] Next, the sample was immersed in hydrochloric-acid 20 g/L, the anodic dissolution was carried out for 60 seconds in +250mV to the normal hydrogen electrode, SEM observation was performed [visual field / of 2 / pit / 0.5-5-micrometer] in 20000 times about the pit (2000 times and less than 0.01-0.5 micrometers) 0.05mm, and the number of pits was measured. Well-known photo lithography technology was applied to these alloy bands, after forming the resist mask which has perfect circle-like opening with a diameter of 180 micrometers in the position where it has much perfect circle-like openings with a diameter of 80 micrometers on the single-sided front face of an alloy band, and another front face faces, ferric chloride solution was sprayed in the shape of a spray, the hole was formed, and ten 14 inches mask materials were created. The relation of the poor generating frequency and pit density which were expressed with the poor generating number of sheets of the mask per one lot is shown in Table 1. The material for masks two ranks and whose number of poor masks are two sheets about the material for masks one rank and whose number of poor masks are one sheet about

the material for masks whose number for ten masks of poor among material masks is zero sheet was considered as three ranks, and three or more poor masks were considered as four ranks. Here, the excellent article and the material for masks of four ranks were made into the defective for the material for masks of one to 3 rank. Poor generating frequency went into one to 3 rank in two or more [2000 //mm] pit densities.
[0028]

[Table 1]

Poor generating frequency Pit density (piece/mm²) 1 rank (excellent article) 177002
ranks (excellent article) 26003 ranks (excellent article) 20004 ranks (defective) 1770
[0029]

[Effect of the Invention] For the Fe-nickel system alloy material in which minute inclusion exists mostly about the problem of aperture dispersion of an etching punch station from a completely new viewpoint which is not in the former, this invention the above is unusual in the case of etching processing -- through investigation of that it is hard to produce dispersion in the opening diameter resulting from a hole by introducing detailed inclusion into a material more than a predetermined number positively etching processing -- electron ray transparency -- the transparency which has a uniform aperture even from a micro viewpoint in case a hole is punched -- development of the Fe-nickel system alloy material from which a hole is obtained is enabled

[Translation done.]